REMARKS

The claims have been amended to recite that, in the structures of the invention, in a combination of a filter media substrate and a layer of fine fiber is used, the structure comprises a single filter media layer and a single fine fiber layer. Support for this amendment is shown at page 30, line 8 and throughout the description of the manufacture of a single layer of fine fiber on a single filtration media.

Further, the claims have been amended to recite that the filter media substrate is a high efficiency filter media when tested with a certain diameter particle. Support for this amendment is found on page 7, line 17. High efficiency is tested using the test methods recited in the specification, ASTM-1215-89 with the standard particle and conditions set forth in the specification.

Further, the Examiner should note that the claims have also been amended to recite that the resinous additive material added to the polymer forms a hydrophobic coating on the surface of the fiber. Support for that amendment is found at page 8, line 10. This coating structure is not taught in the art.

These amendments distinguish the structure form the cited art.

Before discussing the details of each art rejection, Applicants respectfully point out that to establish a *prima facie* case of obviousness, three basic criteria must be met.

(1) There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the reference teachings without hindsight to the claimed invention.

(2) There must be a reasonable expectation of success.

(3) The prior art references must teach or suggest all the claim limitations.

See In re Vaeck, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP § 2143 et seq.

No prima facie case has been made. First, there is no suggestion in this art to combine the references without hindsight. Second, there is no reasonable expectation of success.

Hindsight appears to be the method of selecting the references. The Kahlbaugh reference is quite unique and different than all the other references in its structure and operation. It is the only primary reference used against the independent claims that teaches fine fiber. The other

references teach conventional filtration, conventional media structures, conventional polymer materials or conventional macro fiber materials. This combination of references could only have been selected by hindsight. In the filter references there is no reason to believe that the structure and materials fail to provide adequate performance. There is nothing in Kahlbaugh that suggest that adding fine fiber can improve the performance of the structures and materials of the other references. Further Kahlbaugh is a unique structure that operates entirely differently than the structures and materials of the filter references. Kahlbaugh would not be combined with the other references without the application of hindsight.

Fine fiber has a diameter that is generally greater than X10 smaller than typical fiber of the prior art. This fiber size results in a different realm of manufacturing problems, fiber and filter properties. The fibers are more delicate and are more difficult to make. One of skill in this art would not assume that any known polymer material could be made into a fiber and that fiber could survive as a fine fiber in use.

Further, applicants respectfully point out that the claims, as amended, recite a structure substantially different to any of the structures set forth in the primary references, Kahlbaugh et al. or Engel. The claimed structure has a single layer of fine fiber associated with a single layer of a high efficiency filtration substrate. Such a layer is substantially different than any layer described in the cited art or any structure that can be manufactured using a combination of references. On the whole, as shown below, Applicants have demonstrated that the amended claims are unobvious in light of the primary references. Since the independent claims have been demonstrated to be patentable, all claims dependent on those claims are patentable. Applicants, however, will discuss certain of the dependent claims with specificity.

Further, the Examiner should note that the claims have also been amended to recite that the resinous additive material added to the polymer as recited in (e.g.) claims 14, 15, 16 and other independent claims of the application forms a hydrophobic coating on the surface of the fiber. Support for that amendment is found at page 8, line 10. This coating structure is not taught in the art.

In order to improve efficiency, Applicants will first discuss the rejections of the independent claims. Applicants assert that the independent claims are allowable in light of these amendments and comments. After discussing the independent claims, Applicants will discuss

selected dependent claims. Applicant's omission of any discussion of any rejection is not evidence of acquiescence, but simply an attempt to improve efficiency.

Claims 1-7 and 48-52 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Engel, U.S. Patent No. 5,613,992 in view of Kahlbaugh et al., U.S. Patent No. 5,672,399. Applicants understand the Examiner to argue that Engel teaches a pleated media and Kahlbaugh et al. teach a pleated media having a fine fiber layer. The Examiner argues on page 6 as follows:

> It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter media of Kahlbaugh et al. '399 into the air filter assembly of Engel '992 to provide an improved filter media having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al....

Applicants traverse this combination.

Even if the Examiner's assertion is true, introducing the multi-layer structure of Kahlbaugh into the Engel housing will not achieve the claimed single layer structure.

Because of the nature of the Kahlbaugh et al. teaching and the nature of the Engel disclosure, these references are not appropriate for combination. In large part, Engel is directed to a mechanical structure adapted for an air filter. The configuration of the air filter in Engel is to filter air as it passes from the interior to the exterior of the filter. The Engel disclosure, in large part, is a mechanical structure that supports such an airflow format. Engel provides no details regarding the media, does not disclose or suggest a composite media structure and does not indicate that the media needs improvement. The structure is taught to be effective based on its mechanical character. Based on Engel, one skilled in the art would only select an ordinary, conventional media layer.

First, it is extremely important to note that Kahlbaugh et al. do not teach the use of a filter medium having any sufficient filtration properties. At most, Kahlbaugh et al. teach that filtration media may have 10% efficiency, however, the Kahlbaugh et al. reference taken as a whole primarily teaches one of ordinary skill in the art to use a separation medium that has little or no filtration capacity. The concept in Kahlbaugh et al. is a laminate of multiple layers of fine fiber layer and separation layer. The structure is constructed until the fine fiber layers in the assembly obtain needed filtration efficiencies, without meaningful contribution from the medium. The

specification clearly instructs one of ordinary skill in the art to use a non-filtration separation layer and to avoid any meaningful filtration characteristics in the separation layer.

In sharp contrast to Engel, Kahlbaugh et al. disclose a multi-layer, fine fiber separation layere, structure having a fine fiber layer formed on a separation layer having little or no filtration proprties. Since Engel appears to use one layer of filter media and Kahlbaugh et al. use multiple layers of a separation layer without substantial filtration proprties, the combination of Engel and Kahlbaugh et al. is illogical and cannot achieve a useful filter. Further, it would simply be illogical to use a multilayer structure in the Engel reference, since the Engel reference simply suggests one layer of ordinary media as a filtration layer. Further, Kahlbaugh et al. appears to use an air path different than that in Engel, which constitutes evidence of the illogical combination.

Neither Engel nor Kahlbaugh et al. teach any important parameters for filtration efficiency or permeability of the media layers. Since there are no parameters recited in either Engel or Kahlbaugh et al. for defining a filtration media, Applicants assert that the claims are allowable in light of the specification and the claims that recite media having high efficiency. The Kahlbaugh et al. structure certainly has no layer having any substantial efficiency of any kind. Further, all independent claims in the application are now limited to a single layer of media associated with a single layer of fine fiber to form the claimed structure. The claimed structure is unobvious based on any combination of Kahlbaugh et al. or Engel. The references do not teach a filtration structure having a single layer of fine fiber with a single layer of media. Kahlbaugh et al. teach that multiple layers of fine fiber are required, while Engel suggests media without any fine fiber is acceptable.

Claims 53, 55, 62, 64-71, 81, 83, 90, 92-97, 99 and 100 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Kahlbaugh et al. in view of Gallucci. The Examiner appears to argue that the systems shown in Kahlbaugh et al. are identical to the engine intake flow system of claim 53 and the fluid compressor intake system of claim 81 and that the use of the combination of either an addition resin or condensation resin with an aromatic additive is obvious. Applicants respectfully traverse such a rejection.

Kahlbaugh and Gallucci are not combinable. Gallucci teaches conventional fiber and bulk polymer materials and does not relate to fine fiber. As such the references are not combinable.

Applicants assert that, first; the claimed structure has a single layer of fine fiber and a single layer of filtration media. Kahlbaugh et al. suggest that the desirable structures have multiple layers of fine fiber and multiple layers of a non-filter media separation layer. Accordingly, to modify Kahlbaugh et al. by both using a single layer of fine fiber and, secondly, a high efficiency filter media is not obvious in view of the discussions in Kahlbaugh et al. Kahlbaugh et al. clearly show that the filtration properties of the structure is obtained by using multiple layers of fine fiber in association with a separation layer that has little or no efficiency. Accordingly, the structures in Kahlbaugh et al. are so different than the claimed layer, that the claims must be allowable over this art.

Further, the Gallucci reference is used to suggest that the resins in the fine fiber can be combined with an additive material. Applicants assert that the amended claims which recite that the resinous additive material forms a coating on the fine fiber is patentable over the teachings of Gallucci. As read by Applicants, the Gallucci reference teaches that the additive material is dispersed throughout the Gallucci resin for the purpose of reducing the water absorption of the bulk resin. There is no teaching or any suggestion that the Gallucci additive can form a surface coating on the fine fiber or render that fine fiber more durable in use. Applicants believe that the surface coating on the fine fiber contributes at least, in part, to the high temperature, high humidity stability of the fine fiber materials. Accordingly, neither Kahlbaugh et al. nor Gallucci, either singly or in combination would suggest the structures of the invention in claims 53 or 81.

Claims 111, 112, 119, 121-127, 144 and 145 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Copley, U.S. Patent No. 4,364,751 in view of Kahlbaugh et al. and Gallucci. The Examiner appears to argue that the panel structure of the media packs of claim 111 are shown in Copley and that the filtration media structures from Kahlbaugh et al. can be used in the Copley structures while using the Gallucci resinous additive material in the fine fiber. Applicants respectfully traverse the rejection.

Applicants assert that Copley, Kahlbaugh et al. and Gallucci are not combinable as discussed above since they relate to different technologies. Copley discusses a certain pulse-cleaning filter structure without any discussion of filtration media in any form including a cellulosic substrate or a fine fiber layer on a filtration media. Kahlbaugh et al. discuss a very unique multilayer structure having layers of fine fiber separated by separation layers having little or no filtration efficiency. Gallucci discusses specific resinous material having an additive

material, but fails to discuss any filtration media of any sort. As a result, there can be no combination of these references.

More importantly, the amended claims recite that the media pack contains panels having a substrate comprising a single layer of a high efficiency filter medium and a single layer of a fine fiber material. Since Kahlbaugh et al. do not suggest this structure; the combination of references must fail. Further, the claim recites that the resinous additive miscible in the fine fiber material forms a coating on the fine fiber layers. Such a coating is not disclosed in Gallucci and, accordingly, the combination of references must fail. Lastly, the Copley reference teaches nothing about any sort of a filtration media, fine fiber layer or combination thereof of any sort. In the absence of any specific teaching of such a media layer, its combination with other references is questionable. Applicants assert that claim 111 is clearly allowable over this combination of references.

Claims 128, 129, 146 and 147 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Kahlbaugh et al. in view of Gallucci. The Examiner appears to argue that the methods shown in Kahlbaugh et al. are identical to the method claims and that the use of the combination of either an addition resin or condensation resin with an aromatic additive is obvious. Applicants respectfully traverse such a rejection.

Applicants assert that, first, the claimed method uses a single layer of fine fiber and a single layer of filtration media. Kahlbaugh et al. suggest that the methods will use multiple layers of fine fiber and multiple layers of a non-filter media separation layer. Accordingly, to modify Kahlbaugh et al. by both using a single layer of fine fiber and, secondly, a high efficiency filter media is not obvious in view of the discussions in Kahlbaugh et al. Kahlbaugh et al. clearly show that the filtration properties of the structure is obtained by using multiple layers of fine fiber in association with a separation layer that has little or no efficiency. Accordingly, the methods in Kahlbaugh et al. are so different than the claimed methods, that the claims must be allowable over this art.

Further, the Gallucci reference is used to suggest that the resins in the fine fiber can be combined with an additive material. Applicants assert that the amended claims which recite that the resinous additive material forms a coating on the fine fiber is patentable over the teachings of Gallucci. As read by Applicants, the Gallucci reference teaches that the additive material is dispersed throughout the Gallucci resin for the purpose of reducing the water absorption of the

resin. There is no teaching or any suggestion that the Gallucci additive can form a surface coating on the fine fiber. Applicants believe that the surface coating on the fine fiber contributes at least, in part, to the high temperature, high humidity stability of the fine fiber materials. Accordingly, neither Kahlbaugh et al. nor Gallucci, either singly or in combination would suggest the structures of the invention in claims 53 or 81.

Further the recitation of high efficiency in the medium layer differentiates the claims from the Kahlbaugh materials having multiple layers of separation materials with little or no filtration properties.

The Examiner has rejected claims 17 and 19 under 35 U.S.C. § 103 over Engel, U.S. Patent No. 5,613,992, Kahlbaugh et al., U.S. Patent No. 5,672,399, Emig et al., U.S. Patent No. 6,395,046 and Baumann et al., U.S. Patent No. 6,354,296. The Examiner appears to argue that Baumann et al. suggest using polyalkylene terephthalate fibers in the structure of the Kahlbaugh et al. reference. Applicants respectfully traverse.

While Baumann et al. do teach certain conventional fiber structures, Baumann et al. teach no diameter per se. The Baumann et al. reference is silent regarding whether these fibers are thin enough to act as a fine fiber filtration layer or whether such fibers can be incorporated onto any substrate, whether it is a filtration media or the separation layer of Kahlbaugh et al. Without any specific disclosure relating to the nature and the diameter of the microfiber materials of Baumann et al., the rejection must fail and, even if the combination is made, the fibers from Baumann et al. would not form a fine fiber layer as claimed, since Baumann et al. are silent regarding fiber diameter.

The Examiner has rejected claim 18 under 35 U.S.C. § 103 over Engel, U.S. Patent No. 5,613,992, Kahlbaugh et al., U.S. Patent No. 5,672,399, Emig et al., U.S. Patent No. 6,395,046, Baumann et al., U.S. Patent No. 6,354,296, further in view of Asano et al., U.S. Patent No. 6,177,192. The Examiner appears to suggest that the Asano et al. material can be used in the fine fiber layers of the invention. Applicants respectfully traverse the rejection.

Asano et al. do not teach any fine fiber layer. At Column 2, line 20, Asano et al. clearly suggest that the fibers of Asano et al. are ordinary fibers and would not be combinable with the Kahlbaugh et al. fine fiber structures. Without some teaching in Asano et al. that these materials can be made in a fine fiber layer, the teachings are not combinable and, even if combined, would not result in a fine fiber layer.

Claims 132 and 139-143 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Engel in view of Kahlbaugh et al. and Gallucci. Applicants understand the Examiner to argue that Engel teaches a pleated media and Kahlbaugh et al. teach a pleated media having a fine fiber layer. The Examiner argues on page 6 as follows:

> It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter media of Kahlbaugh et al. '399 into the air filter assembly of Engel '992 to provide an improved filter media having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al....

Applicants traverse this combination.

Kahlbaugh and Gallucci are not combinable. Gallucci teaches conventional fiber and bulk polymer materials and does not relate to fine fiber. As such the references are not combinable.

It is extremely important to note that Kahlbaugh et al. do not teach the use of a filter medium having any sufficient filtration properties. At most, Kahlbaugh et al. teach that filtration media may have 10% efficiency. The concept in Kahlbaugh et al. is a laminate of multiple layers of fine fiber layer and separation layer. The structure is constructed until the fine fiber layers in the assembly obtain needed filtration efficiencies, without meaningful contribution from the separation layer. The specification clearly instructs one of ordinary skill in the art to use a non-filtration separation layer and to avoid any meaningful filtration characteristics in the separation layer.

Because of the nature of the Kahlbaugh et al. teaching and the nature of the Engel disclosure, these references are not appropriate for combination. In large part, Engel is directed to a mechanical structure adapted for an air filter. The configuration of the air filter in Engel is to filter air as it passes from the interior to the exterior of the filter. The Engel disclosure, in large part, is a mechanical structure that supports such an airflow format. Engel provides no details regarding the media, does not disclose or suggest a composite media structure and does not indicate that the media needs improvement. The structure is taught to be effective based on its mechanical character. Based on Engel, one skilled in the art would only select an ordinary, conventional media layer.

In sharp contrast to Engel, Kahlbaugh et al. disclose a multi-layer, fine fiber separation layere, structure having a fine fiber layer formed on a separation layer having little or no filtration proprties. Since Engel appears to use one layer of filter media and Kahlbaugh et al. use multiple layers of a separation layer without substantial filtration proprties, the combination of Engel and Kahlbaugh et al. is illogical and cannot achieve a useful filter. Further, it would simply be illogical to use a multilayer structure in the Engel reference, since the Engel reference simply suggests one layer of ordinary media as a filtration layer. Further, Kahlbaugh et al. appears to use an air path different than that in Engel, which constitutes evidence of the illogical combination.

Neither Engel nor Kahlbaugh et al. teach any important parameters for filtration efficiency or permeability of the media layers. Since there are no parameters recited in either Engel or Kahlbaugh et al. for defining a filtration media, Applicants assert that the claims are allowable in light of the specification and the claims that recite media having high efficiency. The Kahlbaugh et al. structure certainly has no layer having any substantial efficiency of any kind.

Further, all independent claims in the application are now limited to a single layer of media associated with a single layer of fine fiber to form the claimed structure. The claimed structure is unobvious based on any combination of Kahlbaugh et al. or Engel. The references do not teach a filtration structure having a single layer of fine fiber with a single layer of media. Kahlbaugh et al. teach that multiple layers of fine fiber are required, while Engel suggests media without any fine fiber is acceptable.

As discussed above, the Gallucci reference teaches combining a certain resinous additive with a polymer for the purpose of rendering the polymer less water absorbent. The amended claims recite the use of an additive that forms a hydrophobic coating on the fine fiber surface. Such a structure is not taught or suggested in the reference. The claims are allowable over the teaching of Engel, Kahlbaugh et al. and Gallucci. Applicants traverse this combination.

Only Kahlbaugh teaches fine fiber. This combination with the other references is not logical.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Respectfully submitted,

24 Feb '03
Date

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification

Please substitute new pages 68-70 in portrait orientation.

In the Claims

Please amend the claims as follows:

Please cancel claim 139.

1. (AMENDED) A filter element comprising:

(a) a media pack comprising:

(i) a construction of a media composite; said construction including a [sheet-like] substrate having a plurality of pleats having a length extending from said first end to said second end, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ;

(ii) said construction having a tubular shape and defining an open interior having a first and a second opposite ends; and

(iii) said [sheet-like] substrate at least partially covered by a single layer, said layer comprising a polymeric fine fiber comprising a fiber with a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes;

(b) a first end cap and a second end cap;

(i) said media pack being secured to said first end cap at said first end of said media pack;

(ii) said media pack being secured to said second end cap at said second end of said media pack;

(iii) at least one of said first and second end caps including a [radially directed] sealing portion; said [radially directed] sealing portion comprising a [polyurethane] material compressible in a direction toward said media pack.

6. (AMENDED) The element of claim [4] 5 wherein the polyvinylidene halide comprises polyvinylidene chloride.

9. (AMENDED) The element of claim [6] 8 wherein the polyvinylalcohol is crosslinked with about 1 to 40 wt.% of a crosslinking agent.

14. (AMENDED) The element of claim 2 wherein the polymeric fiber comprises a condensation polymer, other than a copolymer formed from a cyclic lactam and a C_{6-10} diamine monomer or a C_{6-10} diacid monomer, and a resinous additive comprising an oligomer having a molecular weight of about 500 to 3000 and an aromatic character wherein the additive miscible in the condensation polymer but forms a hydrophobic coating on the fiber.

15. (AMENDED) The element of claim 2 wherein the polymeric fiber comprises a condensation polymer, other than a copolymer formed from a cyclic lactam and a C_{6-10} diamine monomer or a C_{6-10} diacid monomer, and a resinous additive comprising an oligomer having a molecular weight of about 500 to 3000 and an alkyl phenolic aromatic character wherein the additive miscible in the condensation polymer but forms a hydrophobic coating on the fiber.

16. (AMENDED) The element of claim 2 wherein the condensation polymer comprises a nylon polymer, and a resinous additive comprising an oligomer having a molecular weight of about 500 to 3000 and an aromatic character wherein the additive miscible in the condensation polymer but forms a hydrophobic coating on the fiber.

21. (AMENDED) The element of claim 16 wherein the nylon [co]polymer is combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition.

23. (AMENDED) The element of claim [16] 21 wherein the second nylon polymer comprises a nylon copolymer.

48. (AMENDED) A filter element according to claim 1 wherein[:

(a) said sealing portion comprises polyurethane foam having an as-molded density of 14-22 lbs/in^3] said seal is an axially directed seal.

49. (AMENDED) A filter element according to claim [48] 1 wherein[:

(a) said first end cap is ring-shaped defining an open center and includes an inner radial surface facing the open center;

(i) said sealing portion comprising said inner radial surface] said seal is a radially directed seal.

50. (AMENDED) A filter element according to claim [49] 1 further including:

(a) an inner support liner extending between said first and second end caps;

(i) said inner support liner being between said sealing portion and said media pack.

53. (AMENDED) A system including an engine rated at an engine intake air flow of at least 3 cfm and having an air cleaner constructed and arranged to filter the engine intake air; the air cleaner including a housing and a primary filter element operably positioned therein, the primary filter element comprising:

(a) a media pack comprising a sheet-like substrate, said pack having a first end and an opposite second end;

(i) said substrate having a plurality of pleats having a length extending from said first end to said second end, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ; and

(ii) said substrate at least partially covered by a single layer;

(A) said layer comprising a fine fiber having a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a polymer composition selected from the group consisting of:

[(a)] (1) an addition polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer but forms a hydrophobic coating on the fiber,

[(b)] (2) a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber, and

[(c)] (3) mixtures thereof.

57. (AMENDED) The system of claim 53 wherein the condensation polymer comprises a nylon copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition.

75. (AMENDED) A system according to claim 74 wherein:

(a) said pleated construction has a tubular shape and defines an open interior;

(b) said air cleaner housing includes an airflow tube; said primary filter element being operably mounted on said airflow tube;

(c) said primary filter element further includes:

(i) a first, open end cap and a second, opposite end cap;

(A) said media pack being bonded to said first end cap at said first end of said media pack;

(B) said media pack being bonded to said second end cap at said second end of said media pack;

(ii) an inner support liner extending between said first end cap and said second end cap;

(iii) said first end cap including a radially or axially directed sealing portion;

(A) said [radially directed] sealing portion being inwardly directed toward said open interior;

(B) said [radially directed] sealing portion comprising a polyurethane foam material compressed between and against said inner support liner and said airflow tube to form a first radial seal between said primary filter element and said air cleaner housing.

76. (AMENDED) A system according to claim [74] 75 wherein:

(a) said primary filter element further includes an outer support liner extending between said first and second end caps;

(b) said second end cap defines a center aperture; and

(c) said second end cap includes a[n outwardly radially directed] sealing portion;

(i) said [outwardly radially directed] sealing portion comprising a polyurethane foam material compressed between and against said outer support liner and said air cleaner to form a second radial seal between said primary filter element and said air cleaner housing.

81. (AMENDED) A system including a fluid compressor and having an air cleaner constructed and arranged to filter compressor intake air; the air cleaner including a housing and a primary filter element operably positioned therein, the primary filter element comprising:

(a) a media pack having a first end and an opposite second end;

(i) said media pack including a pleated construction of a media composite; said pleated construction including a plurality of pleats having a length extending from said first end to said second end, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ; and

(ii) said media composite including a substrate at least partially covered by a single layer;

(A) said layer comprising a fine fiber having a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a polymeric composition selected from the group consisting of:

[(a)] (1) an addition polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being but forms a hydrophobic coating on the fiber miscible in the polymer,

[(b)] (2) a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber; and

[(c)] (3) mixtures thereof.

85. (AMENDED) The system of claim 81 wherein the condensation polymer comprises a nylon copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition.

104. (AMENDED) A system according to claim 103 wherein:

(a) said pleated construction has a tubular shape and defines an open interior;

(b) said air cleaner housing includes an airflow tube; said primary filter element being operably mounted on said airflow tube;

(c) said primary filter element further includes:

(i) a first, open end cap and a second, opposite end cap;

(A) said media pack being bonded to said first end cap at said first end of said media pack;

(B) said media pack being bonded to said second end cap at said second end of said media pack;

(ii) an inner support liner extending between said first end cap and said second end cap;

(iii) said first end cap including a [radially directed] sealing portion;

(A) said [radially directed] sealing portion being inwardly directed toward said open interior;

(B) said [radially directed] sealing portion comprising a polyurethane foam material compressed between and against said inner support liner and said airflow tube to form a [first radial] seal between said primary filter element and said air cleaner housing.

105. (AMENDED) A system according to claim [103] <u>104</u> wherein:

(a) said primary filter element further includes an outer support liner extending between said first and second end caps;

(b) said second end cap defines a center aperture; and

(c) said second end cap includes a[n outwardly radially directed] sealing portion;

(i) said [outwardly radially directed] sealing portion comprising a polyurethane foam material compressed between and against said outer support liner and said air cleaner to form a second [radial] seal between said primary filter element and said air cleaner housing.

111. (AMENDED) A system including a vehicle powered by a gas turbine engine and having an air cleaner constructed and arranged to filter gas turbine intake air; the air cleaner comprising:

(a) a media pack having a first filter panel and a second filter panel;

(i) each of said first filter panel and second filter panel including a pleated construction of a media composite; said pleated construction, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ including a plurality of pleats;

(ii) said media composite including a substrate at least partially covered by a single layer;

(A) said layer comprising a fine fiber having a diameter of about 0.1 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a polymeric composition selected from the group consisting of:

[(a)] (1) an addition polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer but forms a hydrophobic coating on the fiber,

[(b)] (2) a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber; and

[(c)] (3) mixtures thereof.

114. (AMENDED) The system of claim 111 wherein the condensation polymer comprises a nylon copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition.

128. (AMENDED) A method for filtering air; the air having a temperature of at least 140°F, the method comprising:

(a) directing the air through a media composite

(i) the composite comprising a sheet-like substrate in a pleated construction, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ; and

(ii) the substrate at least partially covered by a single layer, the layer comprising a fine fiber having a diameter of about 0.1 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a polymeric composition selected from the group consisting of:

[(a)] (A) an addition polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer but forms a hydrophobic coating on the fiber,

[(b)] (B) a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber: and

[(c)] (C) mixtures thereof.

132. (AMENDED) A filter element comprising:

(a) a media pack comprising:

(i) a construction of a media composite; said construction including [sheet-like] substrate having a plurality of pleats having a length extending from said first end to said second end, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ;

(ii) said construction having a tubular shape and defining an open interior having a first and a second opposite ends; and

(iii) said [sheet-like] substrate at least partially covered by a single layer;

(A) said layer comprising a polymeric fine fiber having a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber, said condensation polymer comprising a copolymer other than a copolymer formed from a cyclic lactam and a C_{6-10} diamine monomer or a C_{6-10} diacid monomer;

(b) a first end cap and a second end cap;

(i) said media pack being secured to said first end cap at said first end of said media pack;

(ii) said media pack being secured to said second end cap at said second end of said media pack;

(iii) at least one of said first and second end caps including a sealing portion; said sealing portion comprising a [polyurethane] material compressible in a direction toward said media pack.

139. (AMENDED) A filter element according to claim 132[4] wherein:

(a) said sealing portion comprises polyurethane foam having an as-molded density of 14-22 lbs/in^3.

140. (AMENDED) A filter element according to claim 132 wherein:

(a) said first end cap is ring-shaped defining an open center and includes an inner [radial] surface facing the open center;

(i) said sealing portion comprising said inner [radial] surface.

146. (AMENDED) A method for filtering vehicle cabin ventilation air, the vehicle having a temperature of at least 140°F during any period of operation, the method comprising:

(a) directing the air through a media composite

(i) the composite comprising a [sheet-like] substrate in a pleated construction, the substrate comprising a filter medium having a high efficiency when tested with particles having a diameter of 0.01 to 1 μ; and

(ii) the substrate at least partially covered by a single layer, the layer comprising a fine fiber having a diameter of about 0.1 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140°F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising a polymeric composition selected from the group consisting of:

[(a)] (A) an addition polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer but forms a hydrophobic coating on the fiber,

[(b)] (B) a condensation polymer and about 2 to 25 wt% of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer but forms a hydrophobic coating on the fiber; and

[(c)] (C) mixtures thereof.

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Example 18

The following filter medias have been made with the methods described in Example 1-17.

Filter Media Examples

Substrate	Substrate perm (Frazier)	Substrate Basis wt (lbs/3000 sq ft)	Substrate Thickness (in)	Substrate Eff (LEFS)	Composite Eff (LEFS)
Single fine fiber layer on single substrate (flow either direction through media	(+/- 10%	(+/- 10%)	(+/- 25%)	(+/- 5%)	(+/- 5%)
Cellulose air filter media	58	67	0.012	11%	50%
Cellulose air filter media	16	67	0.012	43%	58%
Cellulose air filter media	58	67	0.012	11%	65%
Cellulose air filter media	16	67	0.012	43%	70%
Cellulose air filter media	22	52	0.010	17%	70%
Cellulose air filter media	16	67	0.012	43%	72%
Cellulose/synthetic blend with moisture resistant resin	14	70	0.012	30%	70%
Flame retardant cellulose air filter media	17	77	0.012	31%	58%

Filter Media Examples (Continued)

Substrate	Substrate perm (Frazier)	Substrate Basis wt (lbs/3000 sq ft)	Substrate Thickness (in)	Substrate Eff (LEFS)	Composite Eff (LEFS)
Flame retardant cellulose air filter media	17	77	0.012	31%	72%
Flame retardant synthetic air filter media	27	83	0.012		77%
Spunbond Remay (polyester)	1200	15	0.007	5%	55%
Synthetic/cellulose air filter media	260	76	0.015	6%	17%
Synthetic/glass air filter media	31	70	0.012	55%	77%
Synthetic/glass air filter media	31	70	0.012	50%	90%

Filter Media Examples (Continued)

Substrate	Substrate perm (Frazier)	Substrate Basis wt (lbs/3000 sq ft)	Substrate Thickness (in)	Substrate Eff (LEFS)	Composite Eff (LEFS)
Synthetic (Lutrador-polyester)	300	25	0.008	3%	65%
Synthetic (Lutrador-polyester)			0.016		90%

Media has been used flat, corrugated, pleated, corrugated and pleated, in flatsheets, pleated flat panels, pleated round filters, and other filter structures and configurations.